FIELD MODIFICATION FORM
LOWER PASSAIC RIVER RESTORATION PROJECT

Date:	December 19, 2007
Document:	Amendment to the *2007-12-17 QAPP/FSP Addendum*
Activity:	Using Sediment Traps to Determine Contaminant Concentration on Particulate Matter in Tributaries of the Lower Passaic River
Requested Modification:	Modifying field protocol to use sediment traps on tributaries instead of surface sediment samples
Rationale:	Appropriate sediment sampling locations were not identified on tributaries
Attachments:	Figure 1: Diagram of Horizontal Slit Cylinders Standard Operating Procedure for Collecting Sediment Trap Samples (SOP 55)

The *Work Plan* (Malcolm Pirnie, Inc., 2005) for the Lower Passaic River Restoration Project provides a decision strategy for implementing changes to approved sampling plans to accommodate necessary modifications in sampling techniques and methods. This field modification form provides an amendment to the *2007-12-17 QAPP/FSP Addendum* to address the implementation of sediment traps on the tributaries of the Lower Passaic River to collect suspended matter; sediment traps will substitute for the collection of surface sediment samples on the tributaries. This substitution is necessary because appropriate surface sediment sampling locations were not identified on the tributaries to fulfill the data objectives of the program. The following discussion provides more details on the rationale for this substitution.

One of the goals of the Lower Passaic River Restoration Project Empirical Mass Balance Evaluation sampling program is to determine the chemical characteristics of suspended matter/recently deposited sediments in the tributaries (Saddle River, Second River, and Third River) and the Upper Passaic River. This goal can be achieved in two ways either by filtering large volumes of the surface water, or collecting recently-deposited surface sediments (beryllium-7 bearing) in these tributaries.

Recent field reconnaissance conducted along Saddle River, Second River, and Third River did not find deposits of fine-grained sediments substantial enough to yield adequate sediment volume. Furthermore, a large volume surface water test run conducted at Saddle River on December 5, 2007 did not result in significant solids mass captured by the filter. This test run employed a Steven Institute of Technology Trace Organic Platform Sampler (TOPS) that pumped 140 liters (L) of water through a 0.5 µm cartridge filter. The lack of collected solids mass was due to the fact that total suspended solids concentration during the TOPS test was less than 1 milligram per liter (mg/L; personal conversation with Dr. Su, Stevens Institute of Technology). This concentration suggests that under low flow conditions, very large volumes of water (greater than 1,000 L) will be required to obtain enough mass of solids on the TOPS canister filter to meet the analytical requirements specified in the QAPP/FSP Addendum. Consequently, an alternative method that is easier to implement may be required to meet the program's goal for the tributaries.

One relatively inexpensive and simple method for collecting water column solids is the sediment trap sampling technique. Sediment traps are inexpensive to build and maintain, and they are capable of collecting adequate solids mass in a reasonable length of time to meet the requirements of sample volume for analytical purposes. Sediment traps collect settling solids from the water column, and it is assumed that the trapped solids are representative of the particulate matter collected by the TOPS or any whole water sampling devices. Furthermore, it is also assumed that the chemical content of the trapped solids are similar to chemical concentrations of beryllium-7 bearing surface sediment.

Although the sediment trap technique has been used to determine sedimentation rates and resuspension in lacustrine and marine environments, there are very few applications in lotic systems. Two important studies support the assumptions that results obtained from sediment trap samples are comparable to results obtained by whole water samples and surface sediment samples. Bartsch *et al*. (1996) compared the solids collected in sediment traps and automated water samples in the Upper Mississippi River and found no significant difference between the particle size distributions in the trap compared to the whole water samples. However, their study indicated the volatile organic matter content of solids was lesser in the sediment traps (mean = 9.5%) than in corresponding water samples (mean = 22.7%), and they attributed this bias to under-collection of phytoplankton in the traps. Additionally, Kaiser *et al*. (1990) collected and analyzed surface sediment and sediment trap samples in the Saint Lawrence River. Their study indicated that the polychlorinated biphenyl (PCB) concentration on the solids collected in the sediment trap were reflective of concentrations observed in the surface sediments. These observations indicate that sediments traps have the potential to provide representative samples that can be used to determine the chemical content of suspended particulate matter or recently deposited sediments in the tributaries to the Lower Passaic River.

Different sediment trap designs have been used to determine vertical fluxes in marine environments, including, flat plates, doomed bottles, jars, plastic bags, funnels, and horizontal slit cylinders. Of these techniques, the horizontal slit cylinders (Figure 1) with an aspect ratio (length to diameter) greater or equal to 3 appear to be the best option for the tributaries sampling. To minimize resuspension of trapped solids, the traps will be positioned perpendicular to the flow of water with the narrow slit along the top on the longitudinal axis. It is anticipated that approximately six traps will be deployed in each tributary, although more may be required by individual locations. The traps will be deployed in the stream until enough sediment mass is obtained. Traps will be inspected weekly to assess the amount of sediment that has accumulated. If in the first week it is calculated that sediment accumulation will require too much time to reach needed quantities, additional traps may be deployed to increase the amount of solids captured. The standard operating procedure (SOP) Number 55 for the design, deployment, and retrieval of the sediment traps is attached.

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References:
Bartsch LA, Rada RG, and Sullivan JF. 1996. "A comparison of solids collected in sediment traps and automated water samplers." Hydrobiologia. 323: 61-66.

Kaiser KLE, Oliver BG, Charlton MN, Nicol KD, and Comba ME. 1990. "Polychlorinated biphenyls in St. Lawrence River sediments." The Science of the Total Environment. 97/98: 495-506.

Malcolm Pirnie, Inc., 2005 "Work Plan." Lower Passaic River Restoration Project. Prepared in conjunction with Battelle and HydroQual, Inc. August 2005.

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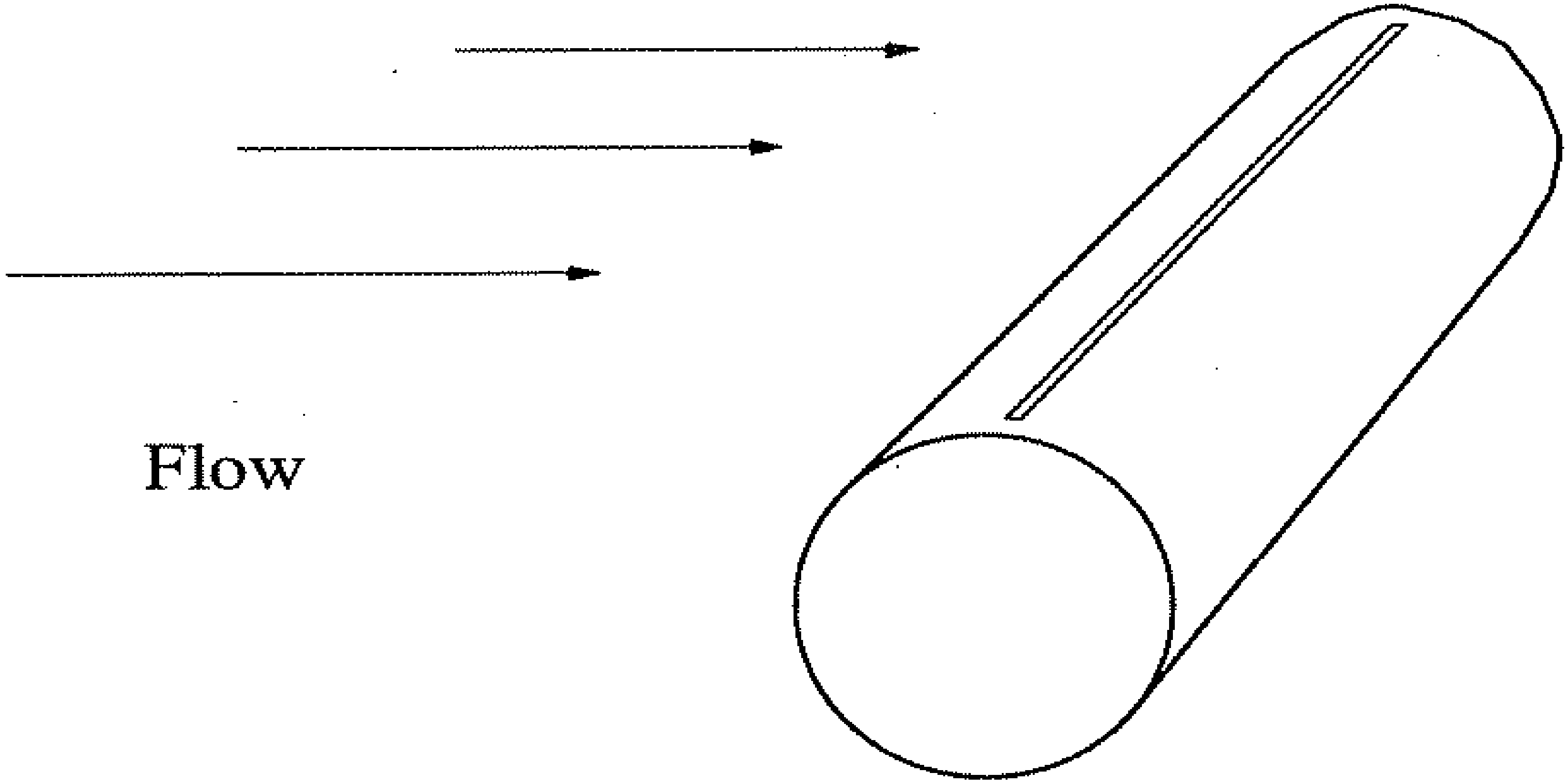

Gardner, W.D, 1980: Sediment trap dynamics and calibration: A laboratory evaluation. Journal of Marine Research, 38(1): 17-39

US Army Corp of Engineers

Silted Cylinder Trap (after Gardner 1980)

Lower Passaic River Restoration Project

Figure 1

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Standard Operating Procedures for Collecting Sediment Trap Samples
SOP 55
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Date: December 17, 2007

1.1 Introduction

This procedure describes the equipment and methods to used to conduct surface sediment collection in the tributaries to the Passaic River employing sediment traps.

1.2 Trap Design

- Trap dimensions will be consistent with the recommendations of Blomqvist and Kofoed (1981) for diameter and Butman (1986) for aspect ratio of greater than three. A slit size of 0.022 times the trap diameter will be made on the top of the trap.
- Trap will be constructed of lexan, plexiglass material or standard Teflon pipe with ends pressed or threaded in to allow simple removal of the sample via the end caps.

1.3 Trap Deployment

- Install two poles in the sediment to serve as support for the sediment trap.
- Attach the sediment trap using holders to the pole supports so that it is perpendicular to flow with the narrow slit along the top on the longitudinal axis.
- The trap should be decontaminated prior to deployment following the guidance in SOP 7. Acetone should not be used as a solvent.
- The trap should be set at an appropriate depth to maximize the capture of settling solids from the water column, while avoiding bed load. The trap depth should also consider water column depth at the deployment location. The trap should be placed at the deepest point possible to maximize sedimentation, with the opening below the mid-depth of the stream.

1.4 Trap Retrieval

- Remove the sediment trap from the holders connected to the two supporting poles being careful to keep the slit on the top.
- Bring the sediment trap upward

1.5 Sediment Retrieval

- Put on clean gloves

- Gently siphon the supernatant water in each trap to within 1-2 cm of the sediment surface
- Open one end of the trap and pour contents into a pre-cleaned container. Homogenize contents from multiple traps and divide sediments into appropriate volumes for the various analyses. Place each analytical aliquot into an appropriate pre-cleaned sample container.
- Place sample containers into coolers packed with ice for shipment to designated lab

Reference:

Blomqvist, S. and Kofoed, C. 1981. Sediment trapping-a subaquatic in situ experiment. Limnology Oceanography 26: 585-693

Butman, C.A. 1986. sediment trap biases in turbulent flows: results from a laboratory flume study. Journal of Marine Research, 44: 645-693.